

The new Future needs for CNS-ATM: An Airline perspective

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Director
Flight Standards and Technology

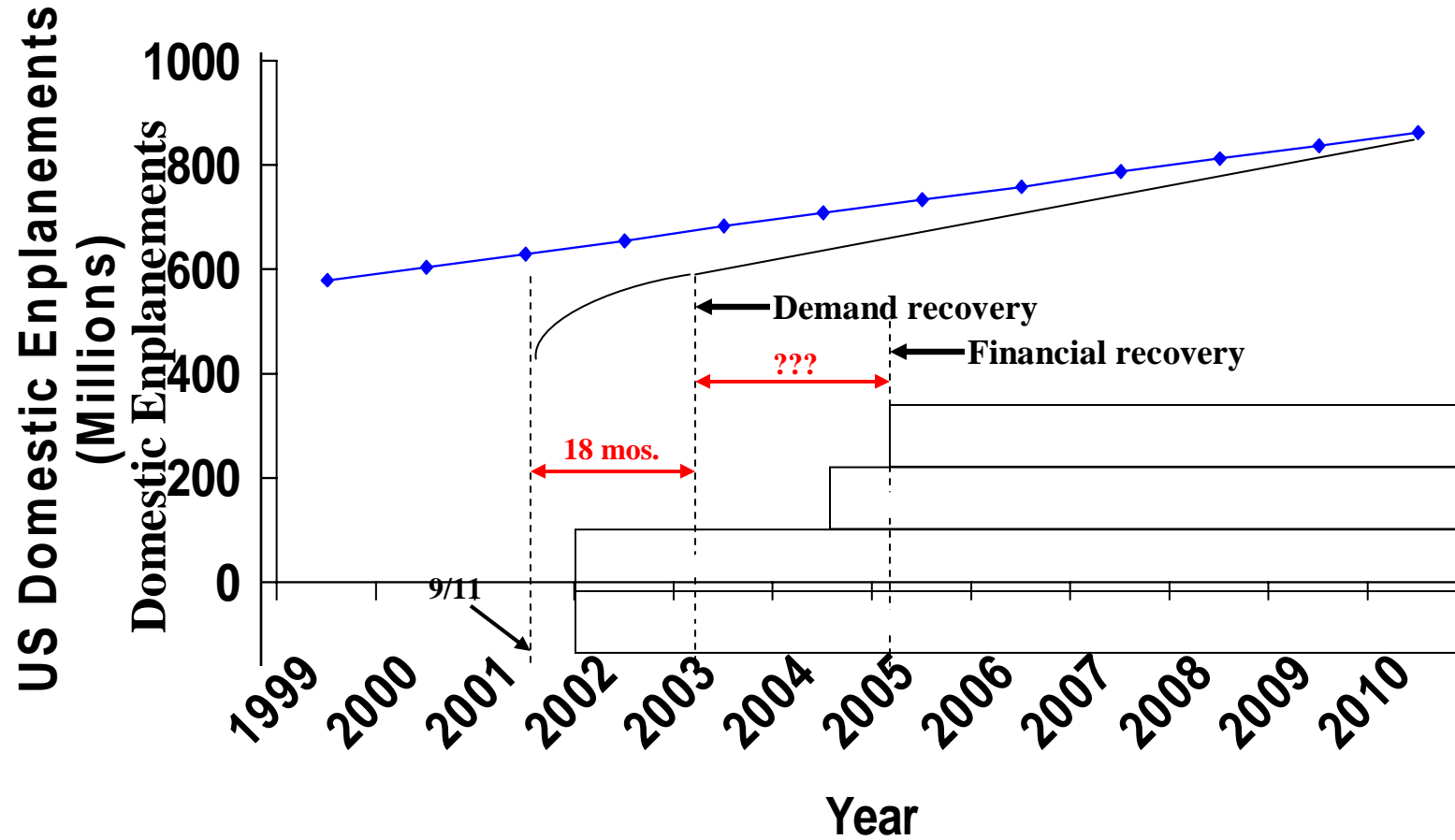


US Future Airspace plans agenda:



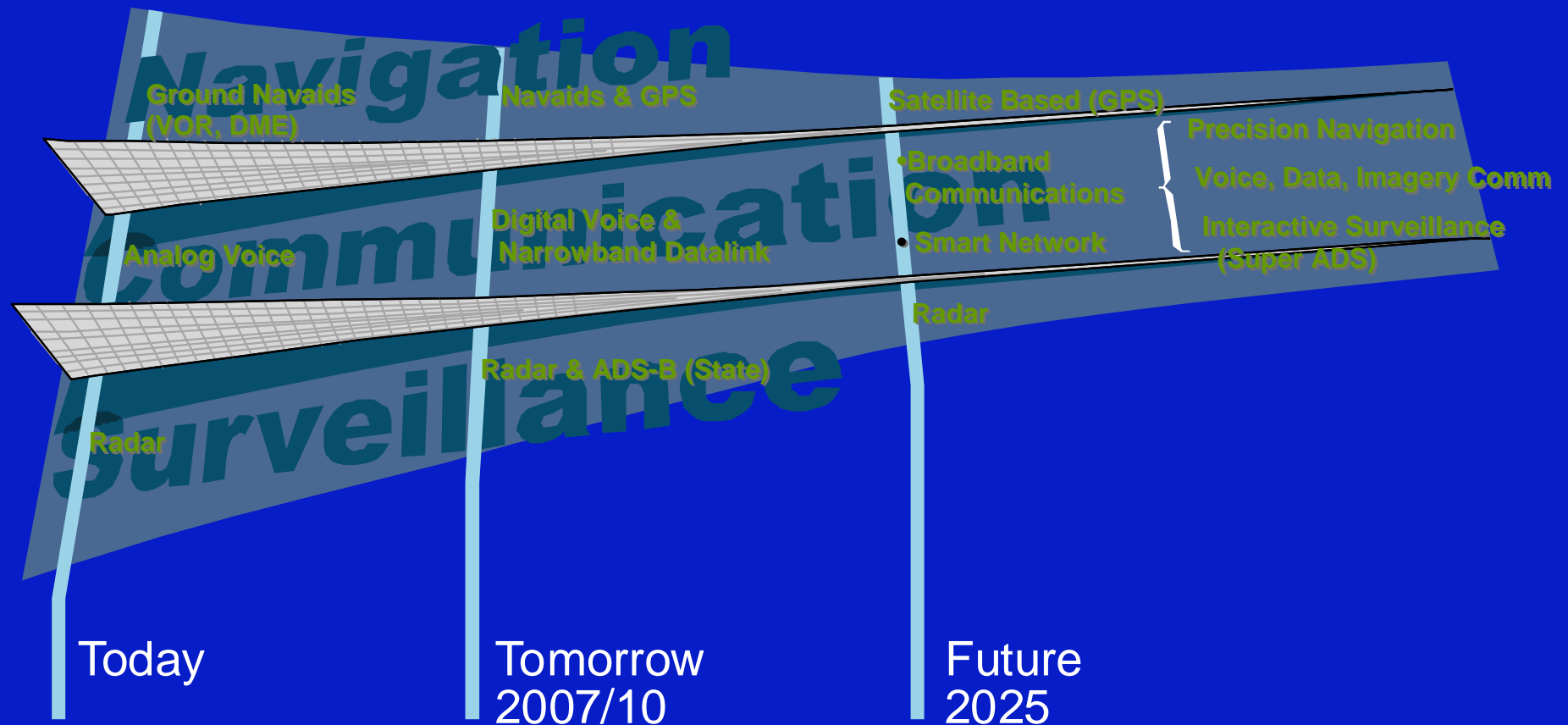
- The Plans
- C/N/S-ATM
 - ▶ Communications
 - ▶ Navigation
 - ▶ Surveillance
 - ▶ Air Traffic Management
- Safety and Security

FAA's Growth estimates





The Vision: Integration & Convergence



FAA OEP





Flight Operations Capital Upgrade Projects



ID	Project #	Task Name	Start	Finish	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2
1	02-047	PWS & X-Band Radar	1/1/02	10/31/06							\$18.06	\$4626M			
2	04-008	EGPWS Installation	1/1/02	8/31/04							No Cost to UAL				
3	04-009	EGPWS Peaks & Obstacles Mode	9/1/04	8/31/06							\$0.75M				
4	02-044	Electronic Logbook	1/1/03	10/29/04							\$0.05M				
5	03-219	Air_Net	10/1/04	12/31/07							\$26.54	\$2101M			
6	TBD	Cabin Surveillance Fleet Deployment	1/1/07	12/31/07							\$10M				
7	04-028	CAPS (MANPADS) - Phase I	1/29/04	8/2/04							\$0M				
8	TBD	CAPS (MANPADS) - Phase II	8/3/04	3/31/06							\$0M				
9	TBD	Aircraft Wireless Concept of Operations	4/1/04	12/31/04							\$0M				
10	02-036	Advanced Nav. RNP0.1 Capability for B757/767	10/1/04	12/31/07							\$25M				
11	02-035	Advanced Nav. RNP0.1 Capability for A319/320	1/3/05	12/31/07							\$26M				
12	TBD	Advanced Nav. RNP0.1 Capability for 400	1/3/05	12/29/06							\$1M				
13	TBD	Advanced Nav RNP0.3 Capability for 737	1/3/05	12/31/07							\$50M				
14	02-038	GLS Precision Landing Capability w/LAAS for B757/767	1/1/08	12/31/08							\$14M				
15	02-037	GLS Precision Landing Capability w/LAAS for A319/320	1/1/08	12/31/09							\$20M				
16	02-039	GLS Precision Landing Capability w/LAAS for B777	1/2/06	12/29/06							\$12M				
17	02-040	GLS Precision Landing Capability w/LAAS for B400	1/1/07	12/28/07							\$10M				
18	TBD	Runway Advisory Alert System (RAAS)	1/1/08	12/31/09							\$3.5M				
19	02-014	Full Face Oxygen Masks	1/3/05	12/29/06							\$9.01	\$4M			
20	02-016	Turbulence Prediction/Detection/Mitigation (Air)	1/3/05	12/31/07							\$4M				
21	TBD	AOC VDL/2 Upgrades (If no AirNet) - 777/A320	1/3/05	12/29/06							\$4M				
22	TBD	AOC VDL/2 Upgrades (If no AirNet) - 400/757/767/737	1/1/07	12/31/07							\$12M				
23	02-029	FANS/CPDLC Domestic - Build 1A	1/1/07	12/28/07							No Cost to UAL				
24	02-141	ADS-B with CDTI	1/1/08	12/31/10							\$50M				

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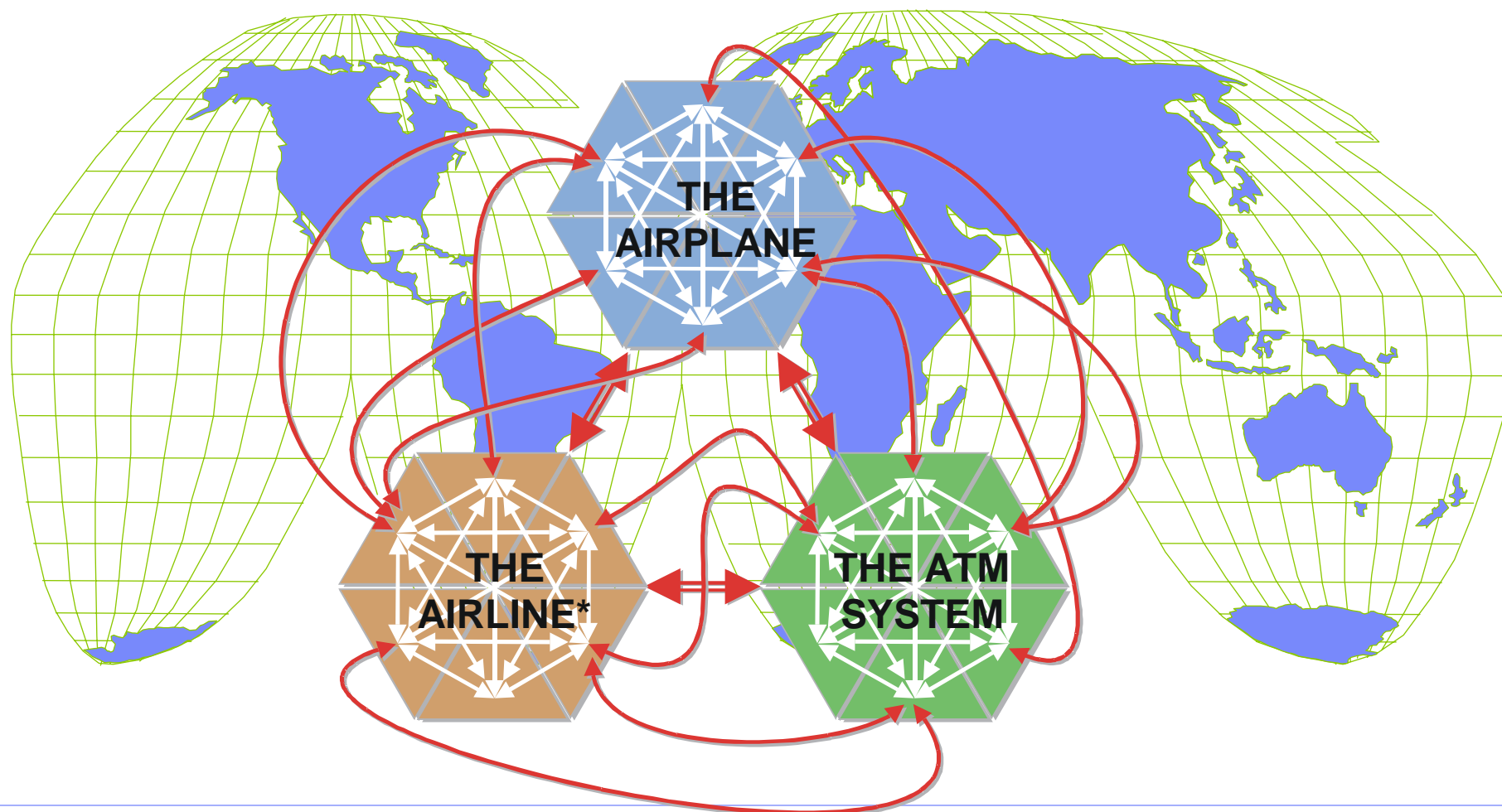
Communications



Communication Requirements



Each Constituent has Multiple Internal and External Direct Connections with the Others, and the World - creating the air commerce web.



Communications: What is the next domestic US Datalink?



Governmental Links:

- 8.33 domestic
- VDL/2
- VDL/3
- VDL/4
- CPDLC
- FANS/1A – FANS2
- Mode-S
- ADS-B – UAT/1090

Commercial (some IP-based) links:

- Connexion
- Swift 64
- Iridium
- Orbcomm
- XM/Sirius
- Verizon Airfone
- Air Cell
- Aero 3G

Communications: ADLS/IP-Based Airborne Internet! (Required service level performance of all CNS)



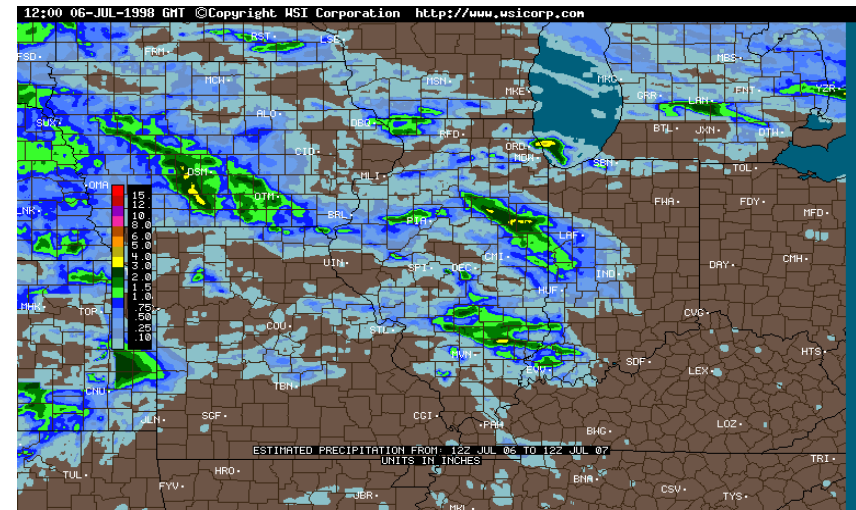
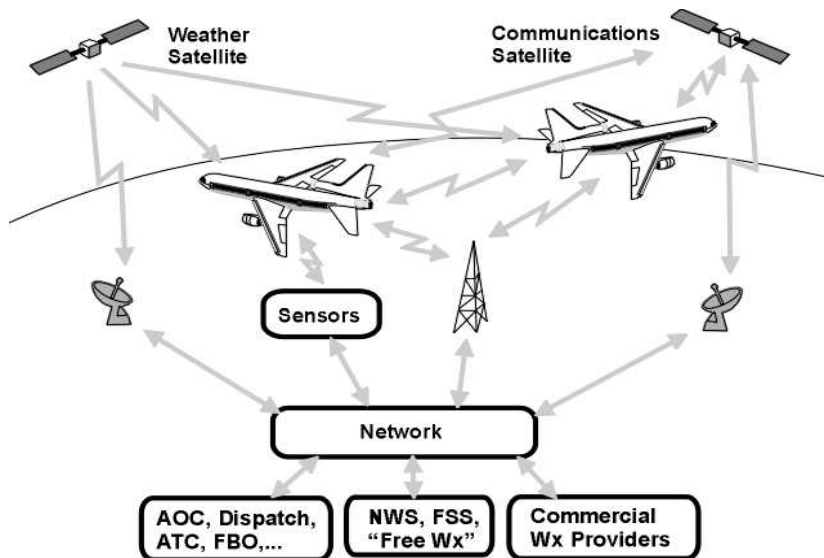
Governmental Links:

- ~~8.33 domestic~~
- ~~VDL/2~~
- ~~VDL/3~~
- ~~VDL/4~~
- ~~CPDLC~~
- ~~FANS/1A – FANS2~~
- ~~Mode-S~~
- ~~ADS B UAT/1090~~
- 25kHz VHF

Commercial links:

Connexion
Swift 64
Iridium
Orbcomm
XM/Sirius
Verizon Airfone
Air Cell
Aero 3G

Communications: Weather information

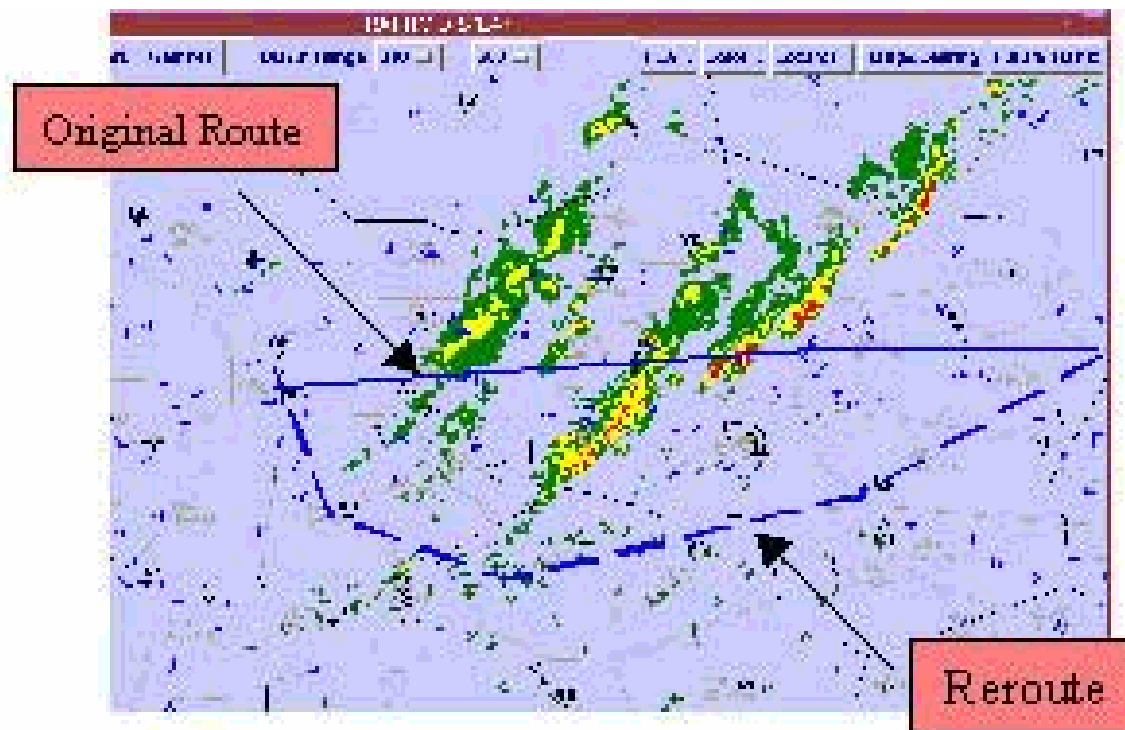


Enable high quality/graphical, timely weather information to all users promoting safety and efficiency.

Provide greater access/connectivity across all users/platforms on the information network, both airborne and ground-based, nationally as well as worldwide.

Promote an integrated global information network enabling collaborative decision-making further enhancing aviation safety.

Communications: Respond Better to Hazardous WX

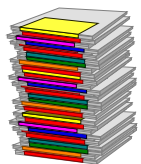
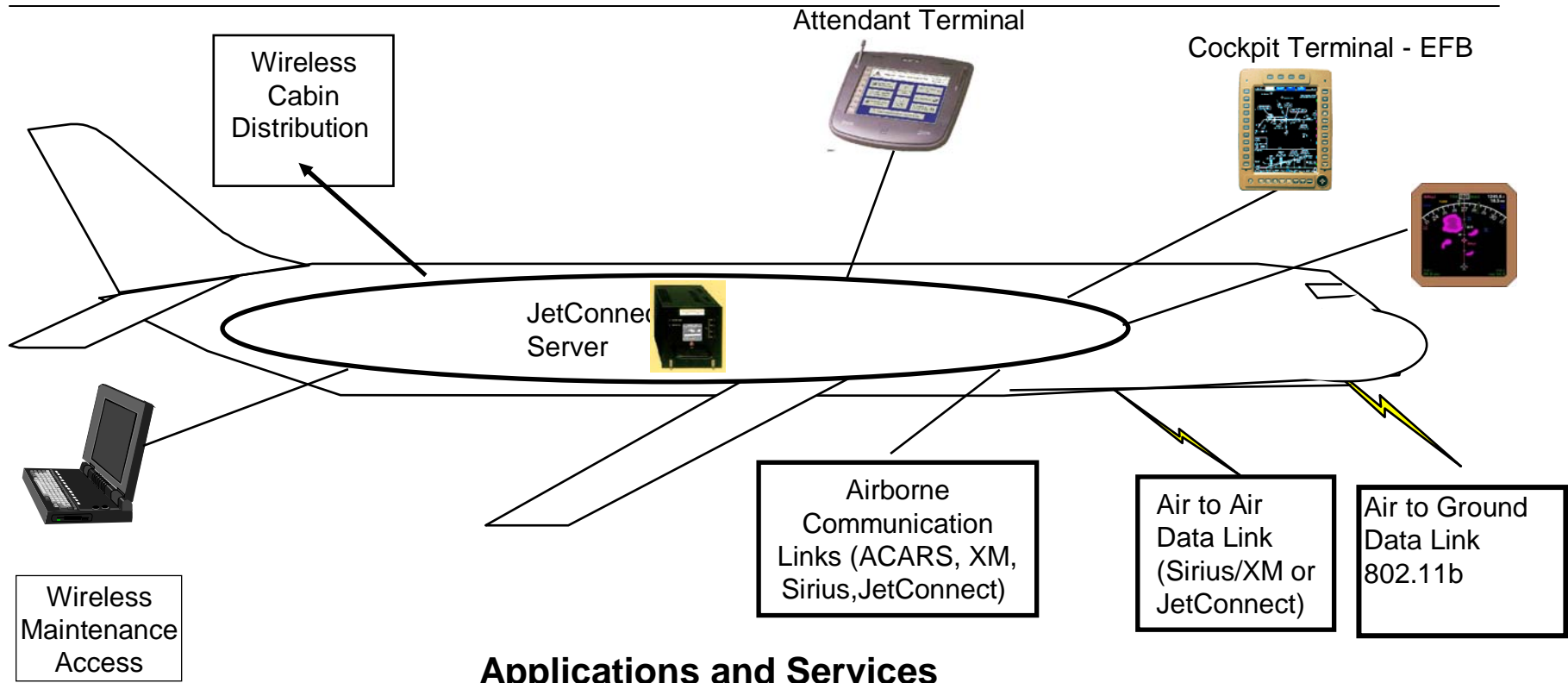


En Route

Communications: Live Weather with Datalink



Communications: Using Wireless in aircraft



Flight Operations

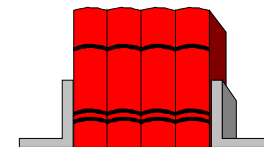
- Weather
- Electronic Manuals/Charts
- Cabin Surveillance
- Surface Moving Maps
- Flight Papers/Data

Onboard/Passenger

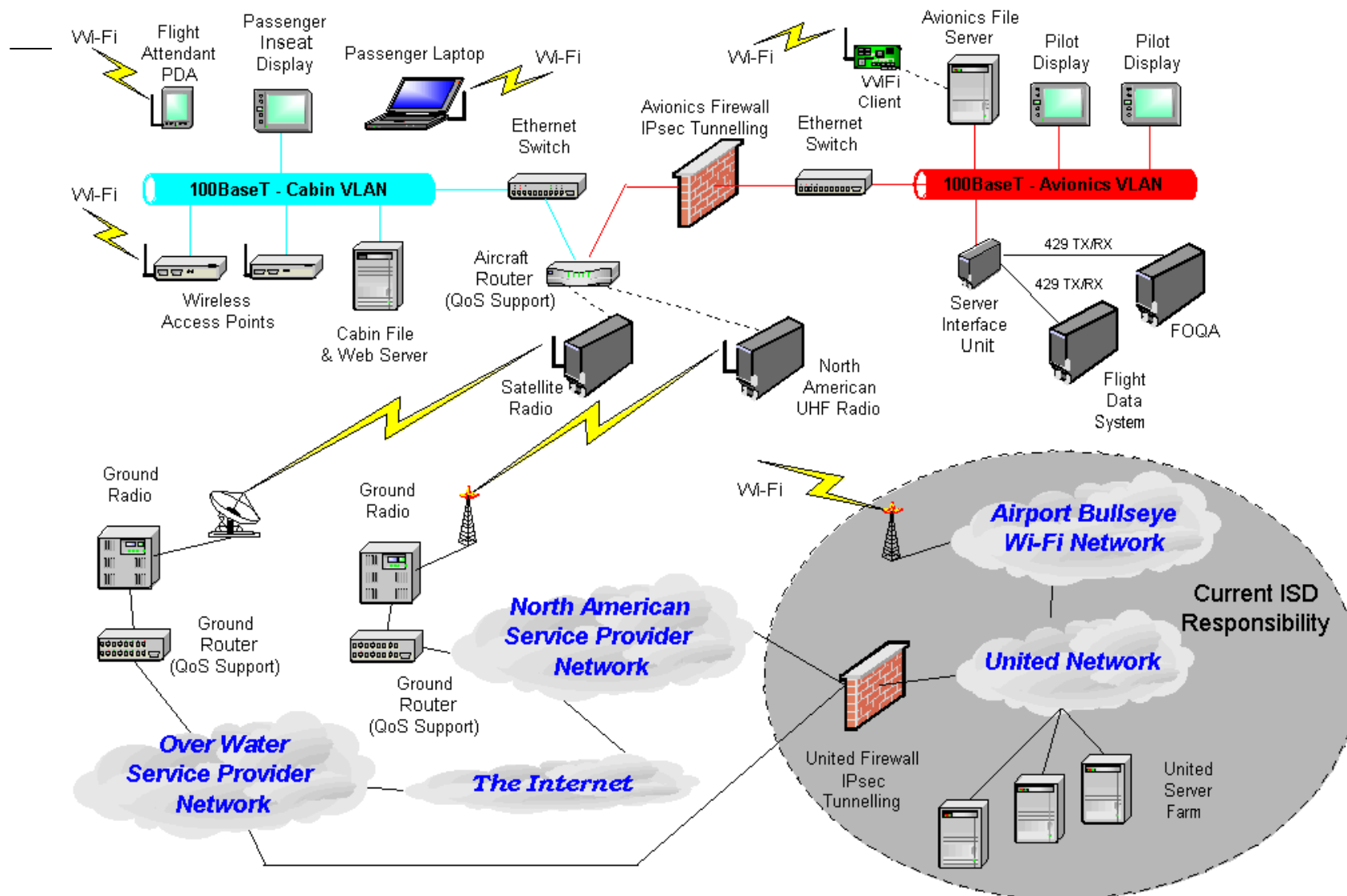
- Rebooking/IRROPS
- Customer Profiles
- Buy On Board
- Live Audio
- Email/WAP Browsing

Maintenance

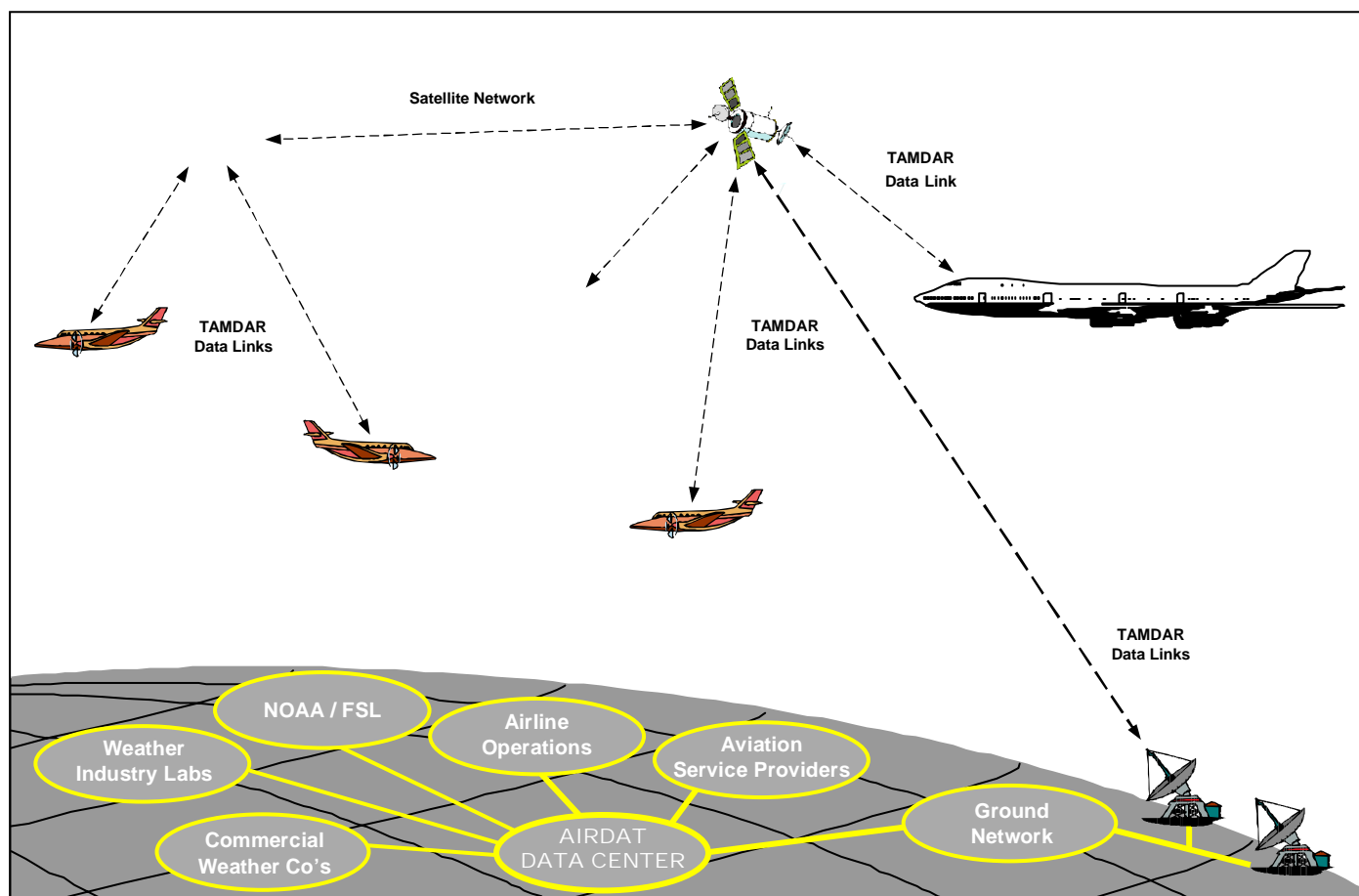
- *FIX
- Flight Data Downloads
- Electronic Logbook
- Maintenance Data Collection
- Electronic MEL



Air_Net Architecture



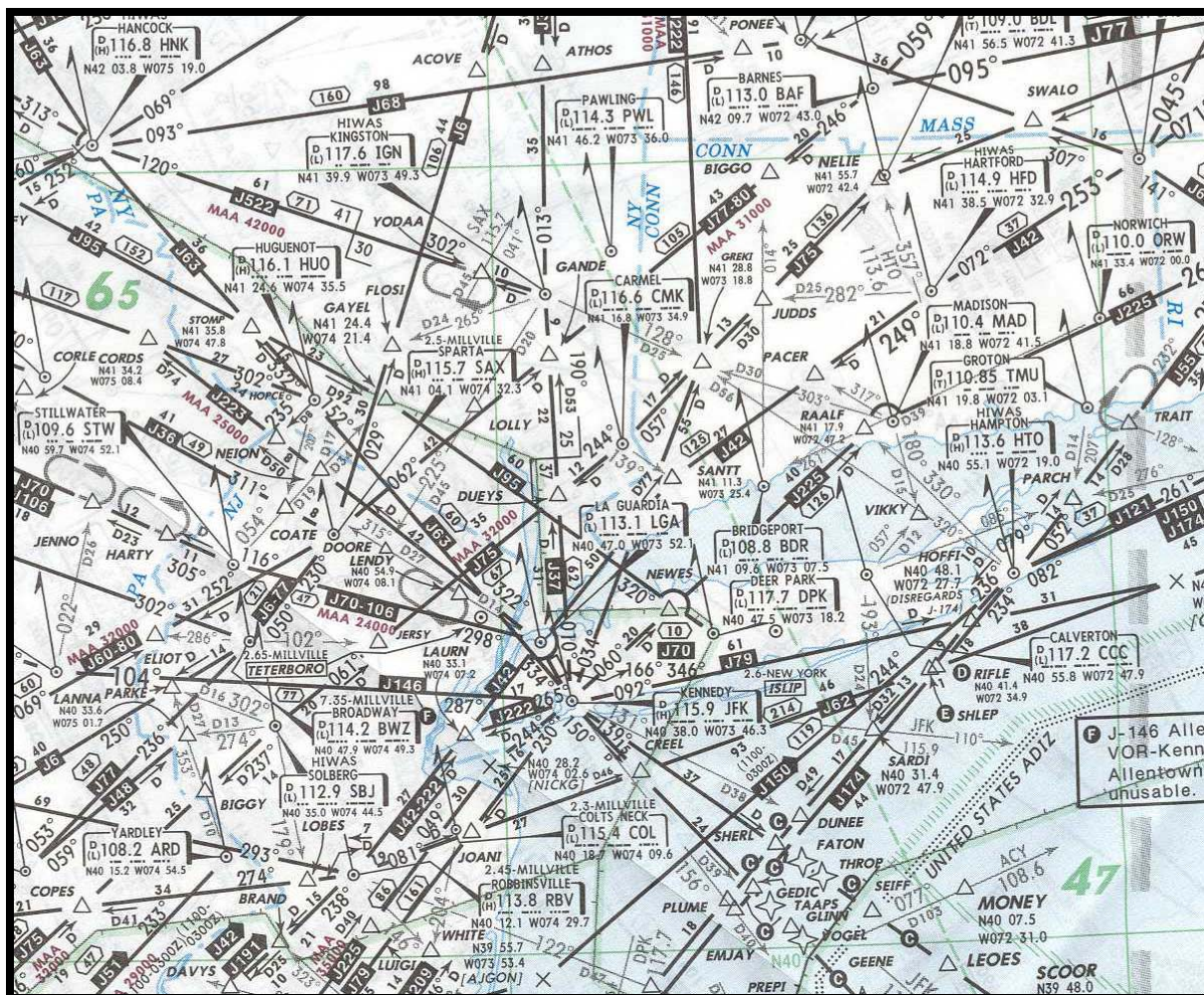
The TAMDAR network: Using commercial Iridium net for flight apps



Navigation



Navigation: Airspace Data Growth



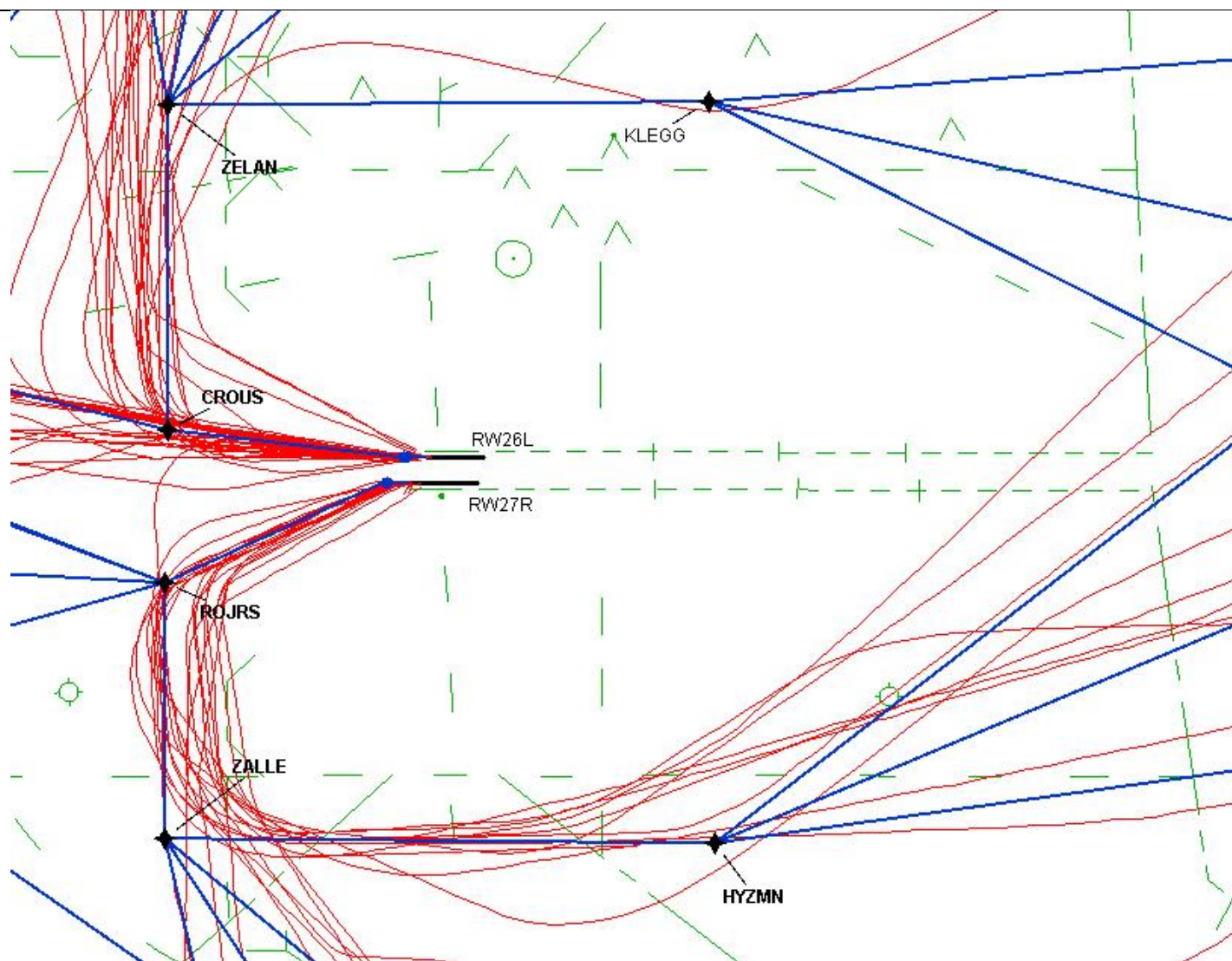
2003

Navigation: Redesign of Terminal Airspace & routes

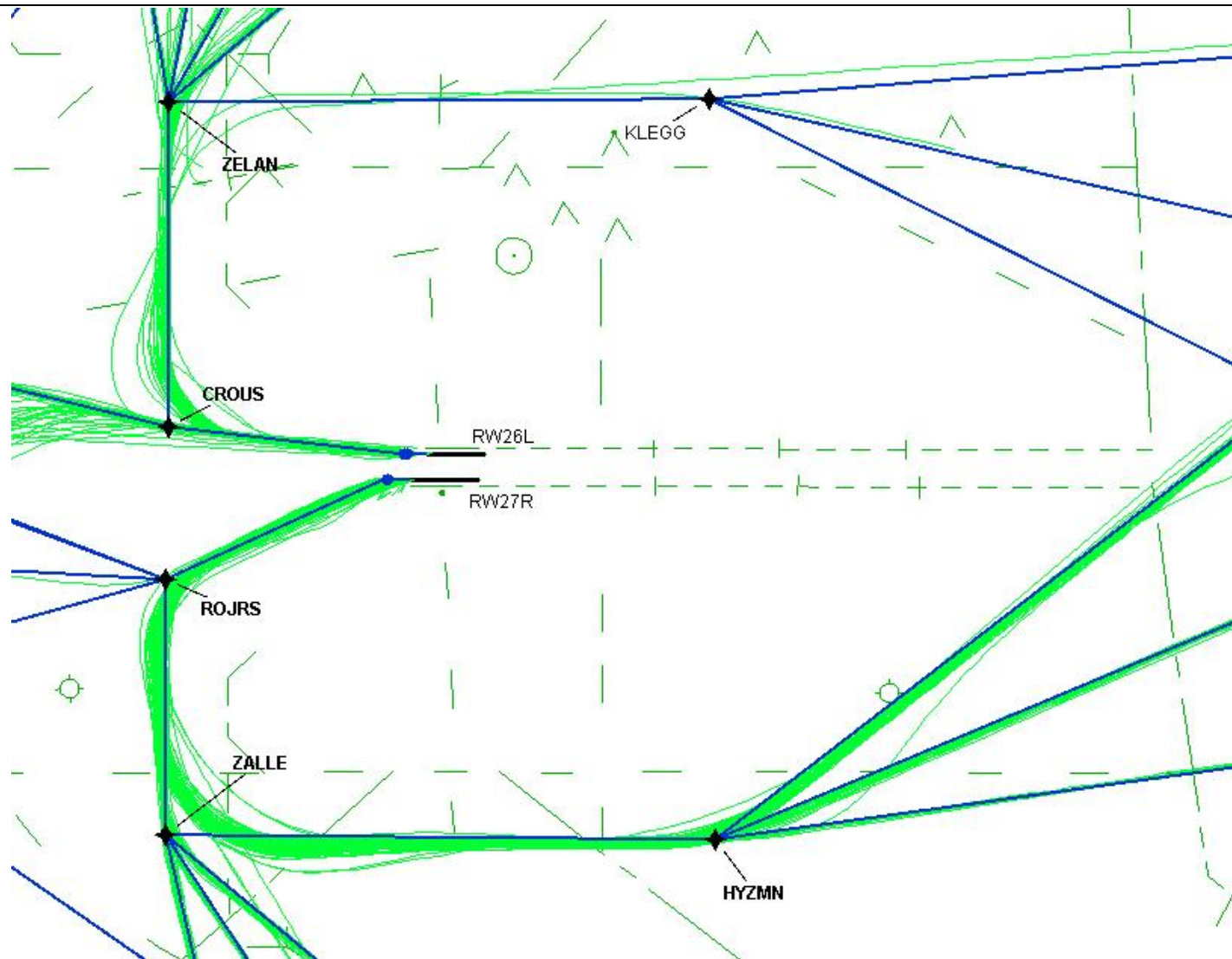


- RNAV routes are critical to reduce voice and airspace congestion
- Recommend immediate development and implementation of RNP/RNAV routes in terminal environment
- Routes should be non-sensor specific, allowing the most aircraft to participate

ATL Non RNAV Tracks



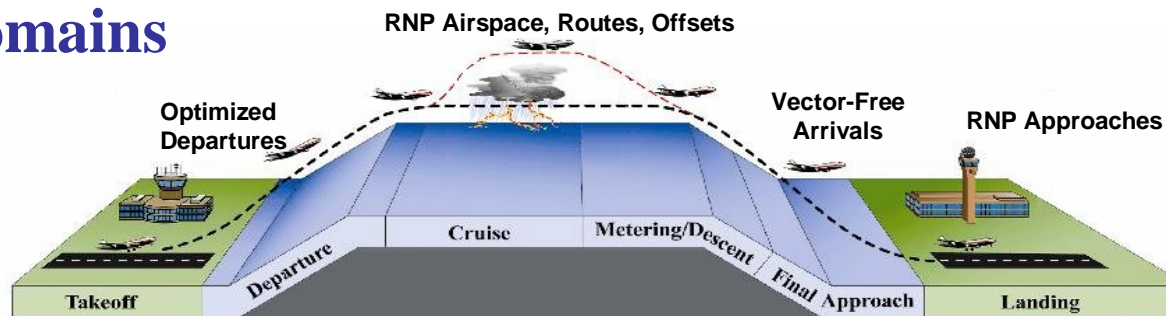
ATL with RNAV Tracks





Required Navigational Performance (RNP) Roadmap Strategy

Domains



Timeframes (Near, Mid, Far term)

CY2003				CY2004				CY2005				CY2006				CY2007				CY2008				CY2009				CY2010 ... CY2020	
Qtr 1	Qtr 2	Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr 3	Qtr 4		

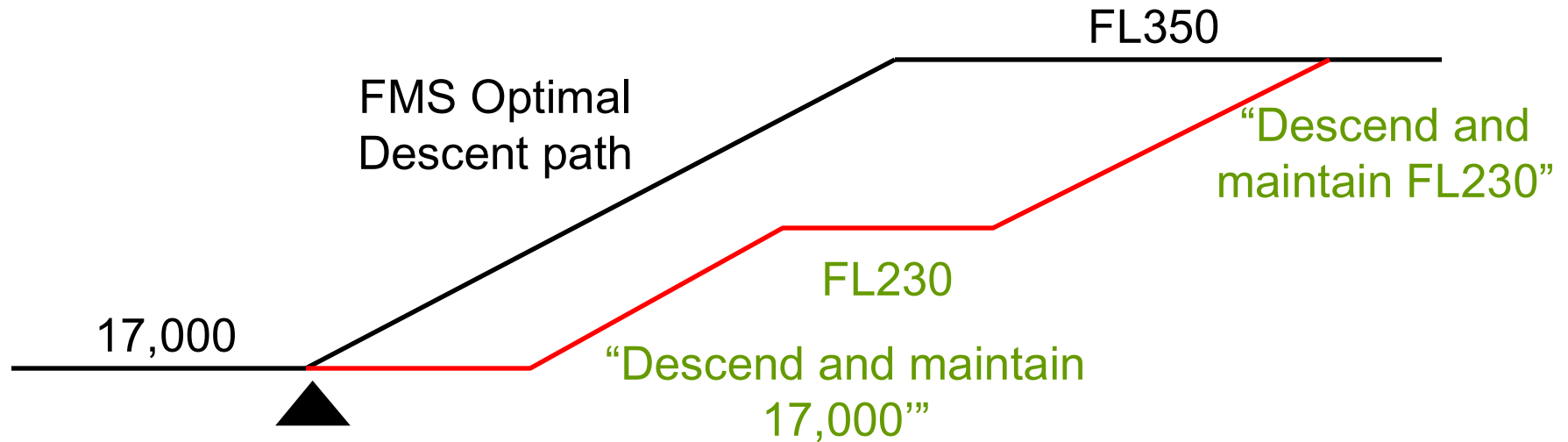
← **Near term** → ← **Mid term** → ← **Far term** →

Leverage existing user
capabilities

RNP in all phases of flight
Consensus for equipage

Advanced concepts
Reduction of ground
NAVAIDS
Possible equipage mandates

Navigation: 3-D Navigation - Idle Descents



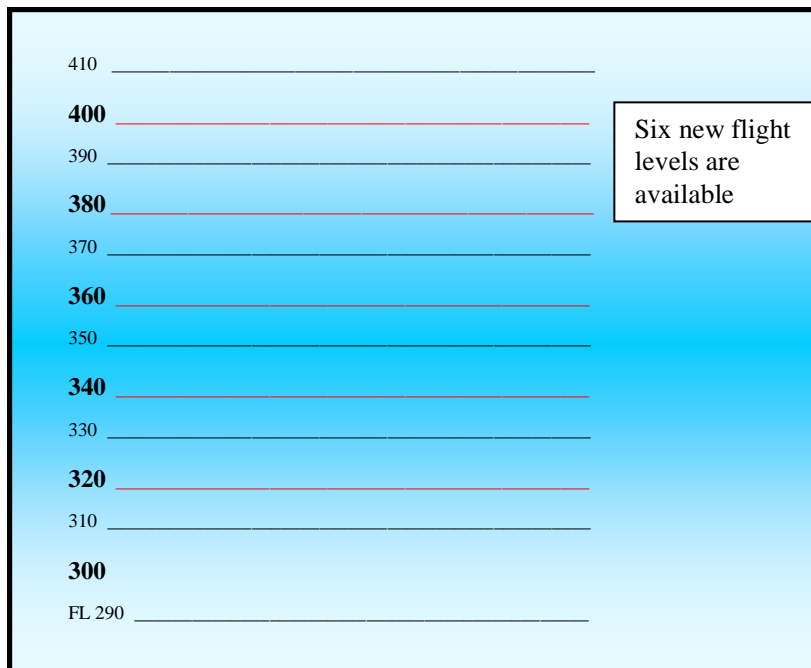
- Current FMS aircraft can calculate optimal descent point to arrive right at fix and altitude
- Optimal descent at flight idle saves fuel and environment

- United currently working with ZDV, ZLA, and ZAU Centers and TRACONS
- Flight trials show 200-400 lb/flight savings across fleet per idle descent...

Surveillance



Surveillance: Implementation of Domestic RVSM



- Offers 6 new flight levels
- 1/2-1% reduced fuel burn for domestic operations
- Offers ATC flexibility
- High return project for U.S. airlines

Surveillance: Enhanced All-WX Surface Ops



Final Approach, Runway and Taxiway Occupancy Awareness



Inputs can include: TIS-B (via ASDE-X) and RAAS

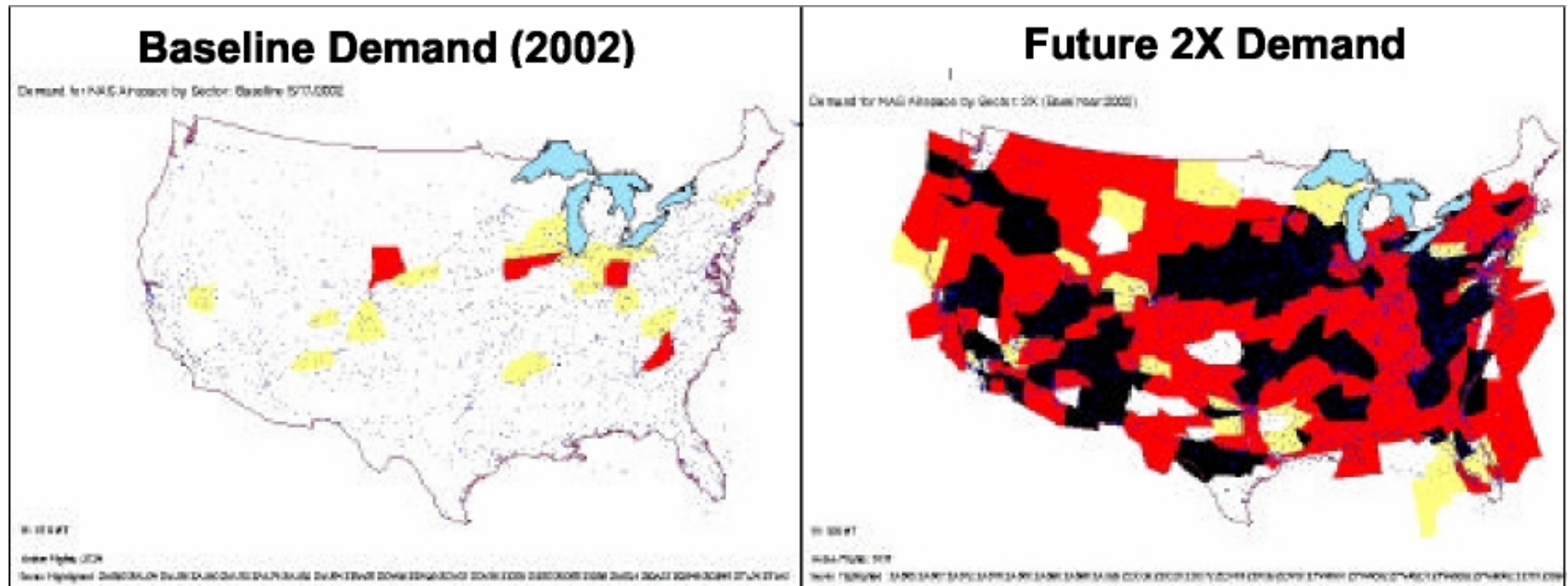
Surveillance: UAL Surface Moving Map



Air Traffic Management



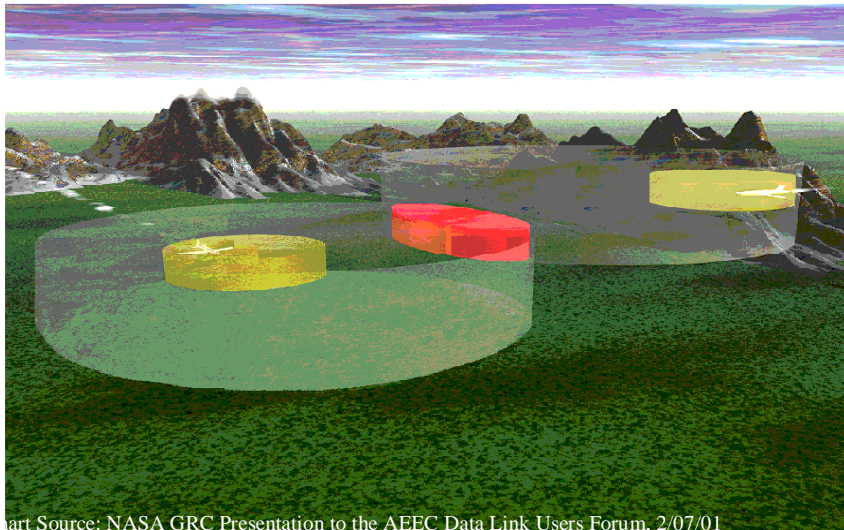
Why do we do anything?



Air Traffic Management



- Air Traffic Control becoming Air Traffic Management
- Traditional control instructions from the 1930's
- Tremendous recent increase in automation tools
- Controllers must maintain “bubble”
- Aircraft can now “self separate”
- Future system to be satellite based
- We must not optimize future technology on current procedures



Part Source: NASA GRC Presentation to the AEEC Data Link Users Forum, 2/07/01

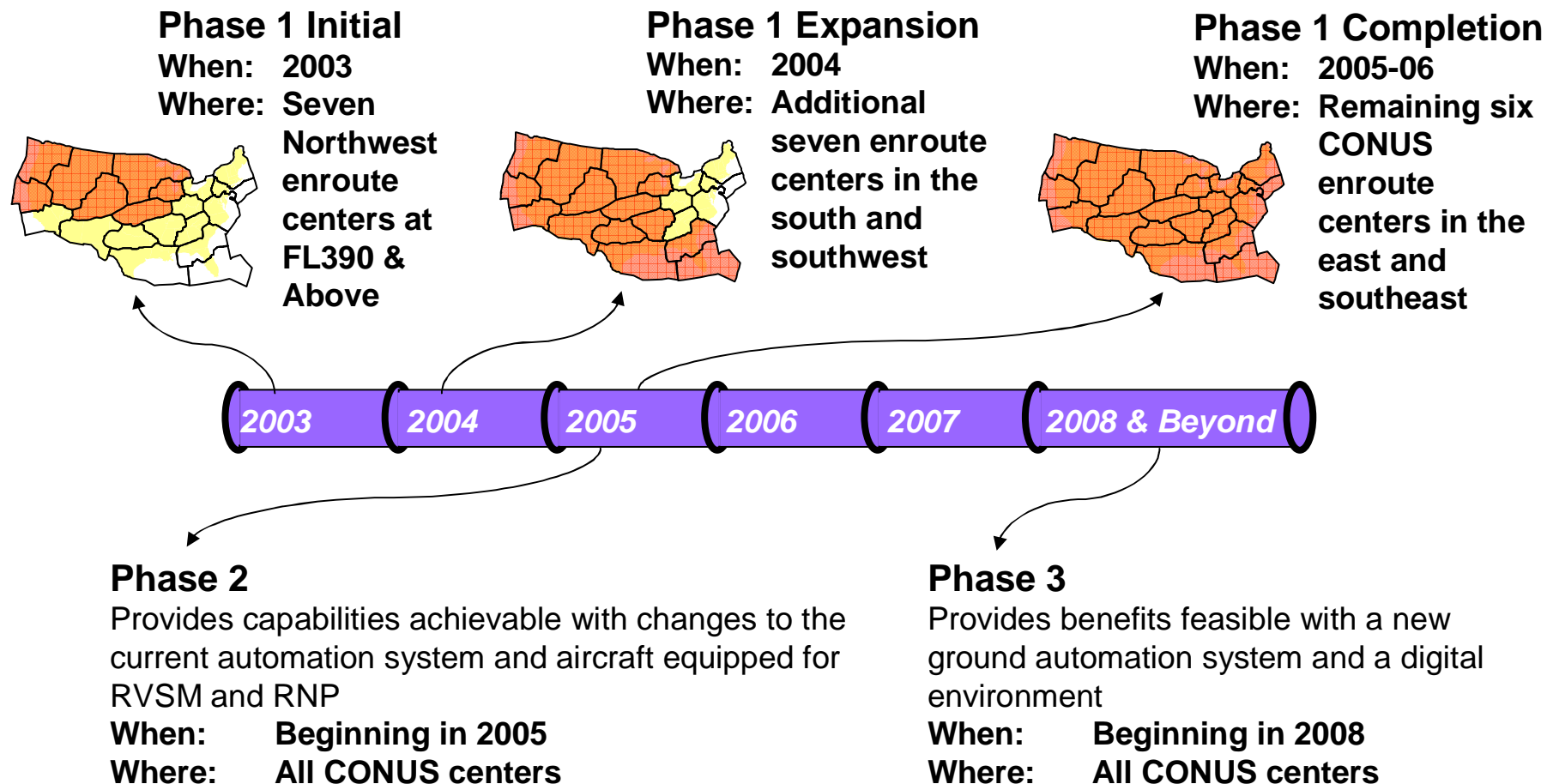


- Evaluate 35 OEP Airports for capacity
- S2K, CDM
- Develop RNAV/RNP procedures
- Increase PRM, B/CDM, and FMA approaches
- Increase TMA, URET deployments
- Redesign Airspace
- Implement HAR
- Optimize Comms
- Oceanic procedures
- Concentrate on Wake issues

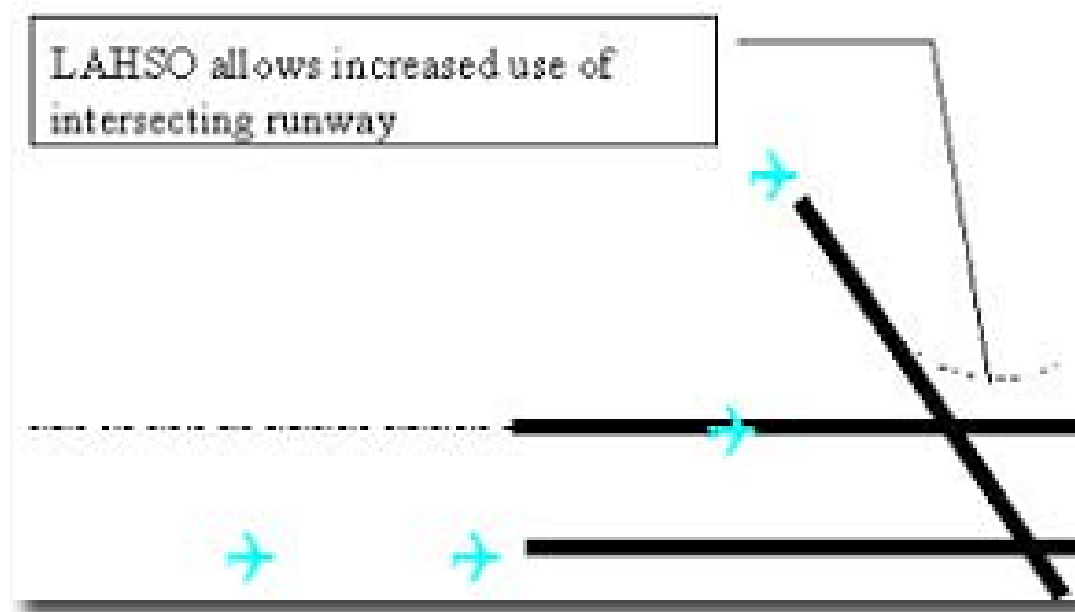
National Airspace Plan



Air Traffic Management: Implementation



Simultaneous Operations Intersecting Runway - SOIR



- Adds 10 Arrivals/hour at ORD
- Adds 30 Departures/hour
- Increase in system throughput

Simultaneous Offset Instrument Approaches SOIA at SFO



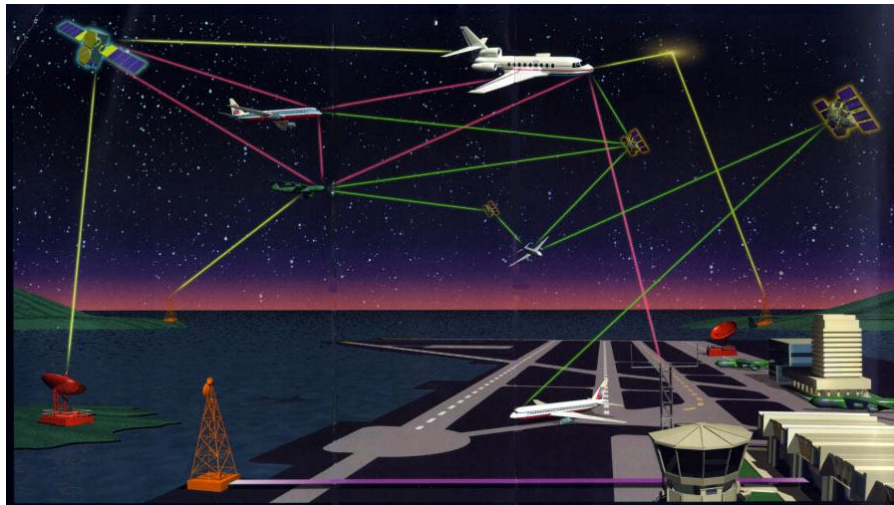
ILS 28L, ILS-PRM
28R - OEP element

- 10 and 15% of operating days will gain benefit from SOIA/PRM
- 25-30% Arrival rate increase over single runway option
- Will allow dual runway operations to 2,100 foot ceilings initially, later to 1,600 feet, & visibility of 4 miles
- Began 10/26/04

SATS – Small Aircraft Transportation System



- Network carriers as “broadband”
- Regionals (Commuters) as “mid”
- Micro jets as “dial-up”
- Trains, buses, autos to “server” hubs



- United Airlines as a member
- Looks at all aspects of transportation
- Total intermodalism
- Views passenger flows as “bandwidth”

New aircraft types; VLJ's adding part of 60% of all air traffic by 2025



New aircraft types;
UAV's adding part of 60% of all air traffic by 2025



Black Widow



Golden Eye



Firescout

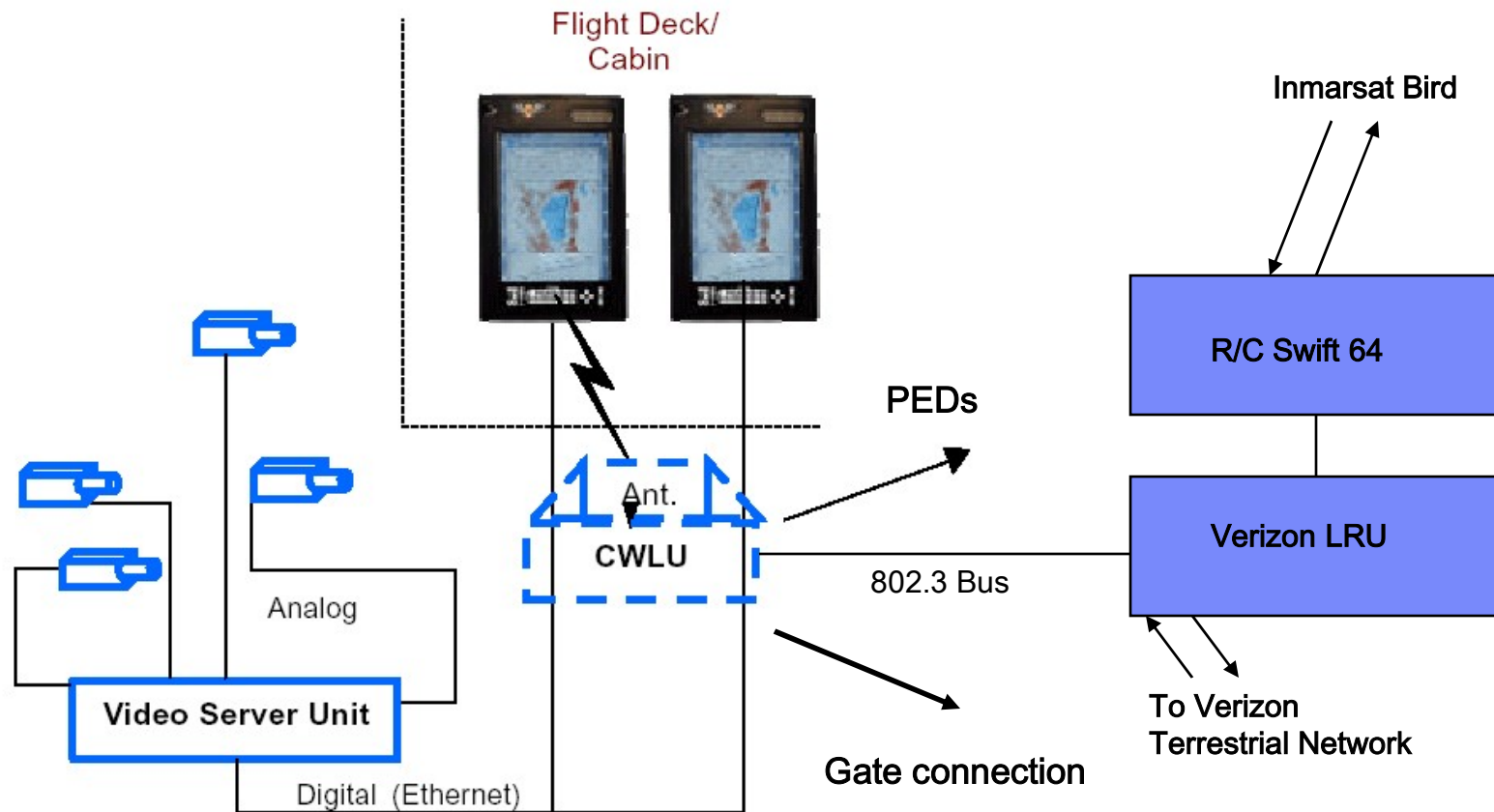


Predator

Safety and Security



B747-400 Cabin Surveillance Phase 2 Evaluation System



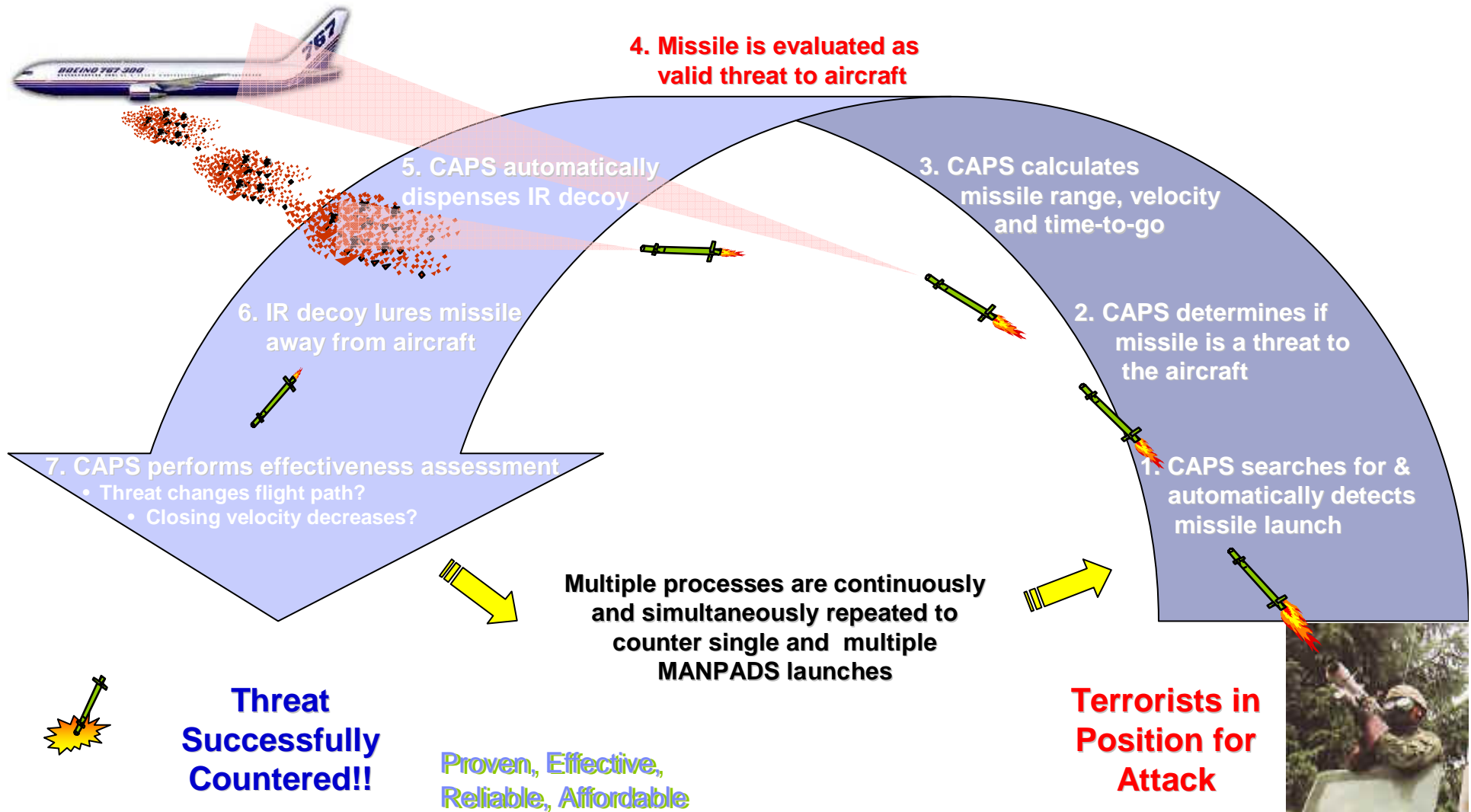
Cabin Surveillance Phase 1 - Wireless Portable Display



Secondary Barrier on B-757



UAL Counter-MANPADS Process



Finally...



How do we get to 2025?

- Integrate and fund the Plans
- Build “minimum standard” aircraft
- Stick to commitments – voice/datalink?
- Plan for the future, but take incremental actions
- Focus on commonality
- Work with a few key programs
- Institutionalize Project Management
- Help us with our CFO’s...

Thank You!



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Questions?

